REQUIREMENTS OF NEW DEVELOPMENT

A. GENERAL

Premise

The land use change that accompanies development causes an increase in nutrient load to area waterbodies. The increase in impervious area coupled with the expanded storm sewer system provides conditions for the delivery of pollutants to these waterbodies. In addition, inappropriate development practices and sedimentation encourage pollution and require the expenditure of public funds to correct damages and deficiencies.

Goals

The City of Maple Grove recognizes it is essential to promote, preserve, and enhance the quality of the City's water resources and to protect those resources from adverse effects caused by changes in land use. To promote water quality in the City, the requirements of new developments are intended to minimize the need for future lake or wetland restoration programs and promote the reduction of phosphorus loading to the City's waterbodies.

Position

To minimize the impacts of pollution on Maple Grove's water bodies, the owners of future developments will be responsible for reducing or maintaining phosphorus export to undeveloped conditions resulting from a shift in land use and public improvements associated with the new development. On-site or regional treatment of pollutants will be the primary measure to treat stormwater. This position is supported by Minnesota Statutes 462.358.

Intent

This section of the plan will establish the procedures by which developments and subdivisions will be reviewed in order to minimize environmental damage and protect the residents and the City of Maple Grove from incurring high maintenance and capital costs resulting from the need to correct water quality problems. Two activities centered on achieving this goal are: 1) erosion and sediment control on new developments and 2) post-development phosphorus control.

Scope and Application to Development

All new construction, subdivision or development will be required to submit an erosion and sediment control plan. Exceptions will include isolated individual single family dwellings; and extensions, enlargements, additions, changes or alterations to existing single family dwellings. Single family erosion control at time of building permit will be administrated in accordance with Section 441 of the City Ordinances.

B. EROSION AND SEDIMENT CONTROL

Every development whose subdivision matter is referred to the City Council shall be required to submit an erosion and sediment control plan. Sedimentation ponds shall be designed and constructed as detailed in chapter 2 (sized to retain 6" of runoff during mass grading operations, 2 inches of runoff after turf establishment, and SWMP standards after 75% of the development has been built).

In addition to those requirements existing in the City Code, the erosion and sediment control plan shall include:

1. The property boundary and lot lines.
2. Two foot contours extending 200 feet beyond the property lines.

3. A drainage plan of the site delineating the direction and rate stormwater is conveyed from the site. The drainage plan shall show directional site and drainage arrows, identify the location of water quality treatment ponds and areas in which stormwater will collect.
4. A delineation of all wetlands and waterbodies and watercourses located on and within 200 feet of the development, noting the normal and high water levels for ponds, wetlands, and lakes.
5. Percent of grade and elevations for streets and parking areas.
6. Basement floor elevations.
7. Utility plans in the area proposed for the development.
8. Identification and design of sedimentation ponding areas to meet with the City requirements as outlined in the erosion and sediment control ordinance.
9. The limits of clearing and grading.
10. A site map that identifies vegetative and structural erosion and sediment control measures to be installed, including temporary and permanent sediment and nutrient basins designed according to the procedure below for assessing pre-development phosphorus export and post-development export of phosphorus.
11. A narrative that describes the project site and erosion and sediment control measures. The narrative must include the sequence of grading and sequence of installation, maintenance and disposition of erosion and sediment control measures, and the construction of permanent and temporary sediment and nutrient basins.

C. POLLUTANTS & NUTRIENTS CONTROL

On-site treatment is the most efficient and cost effective way to keep pollutant and nutrient loading to pre-development levels. Typically, on-site treatment basins are two to three times more efficient than basins designed to trap loads from a number of sites.

Treatment ponds should be provided to trap heavy metals, toxic materials, and sediments rich in phosphorus, nitrogen, and oxygen consuming bacteria. Generally, a pond designed for nutrient removal will also remove heavy metals and other pollutants. Phosphorus is the main nutrient that affects the quality of waterbodies and the primary target of the water quality program.

The following procedure should be used to assess pre-development phosphorus export and post-development export.

1. The PONDNET model should be initialized with the following values:
   runoff total phosphorus(ppb) =See tableSeetable4
   Season precipitation (inches) =19.02
   season length (years) =.41917
2. Runoff coefficients are the following:
   developed areas =See Table
   agricultural areas =0.25
3. Existing drainage areas should be delineated for the site. Any ponds that intercept runoff from the site should be identified and drainage patterns established for them.

   A drainage area that drains to a recreational water body is defined by the following:
   - A watershed that outlets directly to a recreational waterbody.
   - A watershed that drains to a pond or series of ponds that discharges to a recreational waterbody.

4a. Any portion of the site that drains off-site and to a recreational waterbody should be considered contributing to the undeveloped phosphorus load. These areas should be entered into the computer model separately with: Watershed Area (acres) = portion of the site that drains to a recreational waterbody.

Runoff coefficient = the coefficient in step 2, or if more than one land use is in a watershed, a weighted mean for the watershed should be calculated on an aerial basis.

Pond Area (acres) = area of an existing pond that intercepts the watershed and then outlets to the recreational waterbody. If none are present, then use 0.0001 acres.

Pond Volume (acre-ft) = volume of an existing pond that intercepts the watershed and then outlets to the recreational waterbody. If none are present, then use 0.0001 acre- feet.

If one pond is routed to another and then discharges to a recreational waterbody:
Upstream phosphorus load (lbs/yr) = Previous pond(s) outflow phosphorus load.
Upstream pond outflow (ac-ft/yr) = previous pond(s) outflow volume.

4b. If the site is landlocked and does not presently discharge to a recreational waterbody, but future plans route stormwater off-site to a recreational waterbody, then the following pre-development values should be used.

Watershed Area (acres) = site acreage that is proposed to drain to the recreational waterbody.

Runoff coefficient = the coefficients in step 2, or if more then one land use is in a watershed, a weighted mean for the watershed should he calculated on an aerial basis.

Pond Area (acres) = 0.0001 acres
Pond Volume (acre-ft) = 0.0001 acre-feet.
Upstream phosphorus load (lbs/yr) = 0
Upstream pond outflow (ac-ft/yr) = 0

5. The undeveloped “outflow phosphorus load’ in lbs/yr will be calculated for each column (watershed) and appears in row 14. The phosphorus load for each contributing watershed should be added to equal the pre-development loading.

6. The post-development watersheds should be delineated and all areas discharging to the watershed of a recreational waterbody should be modeled. Off-site drainage areas need to be included at this time in the analysis since the larger amount of runoff will affect the efficiency of the pond. The watershed area, new runoff coefficients, pond area and volume and upstream phosphorus load and outflow should be entered into the computer model as in step 4a. The post-development phosphorus load can then be totaled for all watersheds.

7. If the post-development phosphorus load exceeds the undeveloped level, then a pond or several ponds should be designed to bring the post-development loading down to the undeveloped level.

8. The PONDSIZE model developed by Walker (1987) aids in defining the pond design adequate for treatment. The PONDSIZE program requires the following as input parameters:

    1. Watershed area
    2. RCN number
    3. Runoff coefficient (step 2)
    4. Design storm = 2.5 inches

    Several dimension parameters of the ponds are fixed:

    Length to width ratio = 3:1
    Where length = the distance between the inlet and outlet of the pond
    Mean depth >=4 feet and < 10 feet.

    The length of the pond is the one major variable to manipulate to achieve the target volume. The model also calculates the required area for the pond.

9. If a large drainage area cannot be intercepted by a pond and drains directly to a recreational waterbody, this P load has to be "made up" by treating the other drainage areas. This can become problematic as the efficiency of a pond reaches 65-70% and further expansion of the pond volume yields less dramatic phosphorus removal.

10. The resulting phosphorus concentration from the treatment basins should be less than 200 ug/L. When a lake is downstream, the concentration leaving the treatment basin(s) should be entered in the lake models to assess if a rise in phosphorus concentration in the lake is predicted. If a rise is expected, further treatment will be required to prevent a degradation of the water quality of the lake.

    If a downstream recreational waterbody is not a lake, the model will be modified with the new land use and ponding information, and the effects on the downstream waterbody assessed. If a rise in phosphorus concentration is predicted in the recreational waterbody, then further treatment will be required.

Review Procedure

Site plans meeting the above requirements shall be submitted for review in accordance with the following plan approval standards.

A plan may he approved subject to conditions necessary to insure compliance with the goals of this Plan. Such conditions may limit the size, kind or character of the proposed development, require the construction of structures (such as weirs or dikes), storage or treatment basins, or require a site plan alteration to ensure buffering from waterbodies. The City will use the Walker PONDNET model to calculate pre-and post-development phosphorus export.

Plan Approval Standards

Plans must meet the following standards to be approved:

1. Satisfaction of the erosion and sediment control criteria.

2. Sizing and design of the nutrient pond shall be based on the Walker PONDSIZE and PONDNET Models and shall provide for a minimum of 60% phosphorus nutrient assimilation. Nutrient ponds shall meet the design parameters described in the post-development phosphorus control section of this chapter.
3. No development shall be allowed which will result in unusual maintenance costs due to sedimentation of roads and parking areas.
4. Existing wetlands and waterbodies shall NOT be used for primary sedimentation traps or nutrient removal during development.
5. The developer shall provide information required for the design of the pond (e.g. % impervious area, runoff coefficients, district areas.

D. DEDICATION REQUIREMENTS

All new developments shall be required at the City's option, to provide land and construct a nutrient detention pond for the purpose of treating increased phosphorus runoff, generated by the subject development, in accordance with Minnesota Statutes 462.358. The standards and guidelines for that treatment, and any property, easements, or physical improvements shall be related to the amount of phosphorus runoff from the site.

In addition to providing proper ponding, new developments shall also be required to provide mitigative measures if the development results in an increase in the phosphorus concentration of downstream recreational classified waterbodies.

An agreement to construct the required treatment basins or ponding areas and the declaration of such property or easements shall be executed prior to approval of the site plan.

Ponding and Land Dedication

Acquisition of land, or easements for ponds and treatment basins, shall be based on the Walker PONDSIZE model to calculate pond volume, surface size of the pond, and other pond dimensions for a given development. The model will calculate the necessary land to be dedicated for ponding. The City may, at its own discretion, require the construction of one or more ponds even when such ponds cumulatively do not reduce phosphorus loading to predevelopment levels. The City shall require said ponds when it is determined that they are necessary to maintain the integrity of water quality in downstream recreational water bodies.

Special Assessments

If an on-site pond is not feasible, the developing parcel shall be assessed for the costs associated with nutrient removal from regional treatment ponds located off site.

Hardship

The City may vary from the provisions of this Plan where the literal application of the policies would result in a substantial inequitable hardship to the developer. In assessing hardship, the City shall balance the severity of the physical, social, and economic effects of the literal application against the interests of the City in pursuing its water quality objectives. Economic considerations alone shall not constitute a hardship if a reasonable use for the property remains.

Hardship shall be determined through one of the following conditions:

1. The required on-site treatment basin is not sufficient to prevent an increase in phosphorus in a downstream lake or recreational waterbody. In this case the developer will be responsible for a cash dedication equal to the cost of land and pond volume needed for treatment of the remaining phosphorus load.

2. On-site ponding is not feasible due to lot size or site limitations, or due to potential adverse environmental impact. In this case the developer will be responsible for a special assessment equal to the cost of land and pond volume needed for treatment of the phosphorus load leaving the site.

Mitigation

New developments shall also be required to provide mitigative measures if the developments result in an increase in the phosphorus concentration of downstream waterbodies classified in the Maple Grove Stormwater Management Plan.

Mitigative measures shall include but not be limited to: reducing impervious area, additional treatment basin construction, treatment of stormwater discharge through other means, or a special assessment in lieu of as determined by the City. Special assessments shall be equal to the full cost of the land and the pond value needed for treatment of the increased phosphorus loading in the affected recreational waterbody(ies).

WET DETENTION POND DESIGN

Design Criteria for Wet Detention Ponds

1. Hood levels and storage volumes for detention ponds shall be analyzed on a range of rainfall and snowmelt durations to identify the duration that produces the most severe flood level.
2. Permanent pool volume shall be greater than or equal to the volume of runoff from a 2.5 inch rainstorm under full projected development of the watershed (NURP criteria allowing for 25 years of sediment accumulation). In the summer, St. Paul climate, this sizing provides a mean hydraulic residence time of 2 weeks.
3. The pond shall provide an average detention time of at least 6 hours for a 2" rainfall event.
4. All detention ponds shall be designed to accommodate runoff from the greater of the 100 year rainfall or snowmelt storm event.
5. Skimmers shall extend below the normal water level by at least 4 inches and have a discharge velocity that does not exceed 0.5 feet per second during peak discharge.

Sizing Criteria

1. A desirable alternative for all ponds is to construct two or more separate ponds in series with a total volume equal to that specified in the previous Section, part 2.
2. The mean depth of the permanent pool (volume/surface area) should be greater than or equal to 4 feet. If the pond is smaller than 3 acre-feet in volume, mean depths of 3 to 4 feet may be used.
3. The maximum depth of the permanent pool should be less than or equal to 10 ft.
4. The ratio of maximum length (measured from inlet to outlet) to maximum width should be greater than or equal to 3. If the ratio cannot be achieved due to the natural topography, berms and baffles may be used to increase the length of the flow path.
5. For suspended solids removal, NURP standards can best be expressed as relative volume> 2 in. (pond volume/impervious watershed area) and mean depth> 3 ft. (volume/surface area).
6. To provide stability, side slopes below the permanent pool elevation should not be steeper than 3:1 (h:v).
7. A 10 to 15 ft. wide aquatic bench should be provided for the colonization by wetland plants to aid pollutant removal and to provide a safety buffer. This bench should start at a depth of 1 to 1.5 ft. below the permanent pool elevation and have a slope of 10:1 (h:v).
8. A 15 ft. wide maintenance access bench should be placed between the aquatic bench and the toe of the side slopes leading to the permanent pool. This bench should not be steeper than 10:1 (h:v for safety and ease of access) and flatter than 20:1 (h:v to prevent soggy conditions). It is preferable that this area be kept as a meadow rather than a lawn to provide a vegetative buffer strip and control mowing costs.
9. Every pond should have an easement that grants direct access to the pond from a public or private roadway. This right-of-way should have a minimum width of 20 feet and a maximum slope of 5:1 (h:v) and be directly linked to the access bench around the perimeter of the permanent pool.
10. The successive rings of permanently or regularly inundated shallow wetland areas should be provided with landscaping to stabilize slopes, improve appearance, and create wildlife habitat or scenic effects.

Outlet Structure Criteria

1. Outflow from detention ponds shall be designed for the peak discharge from the 100 year storm event.

2. The outlet structures shall be designed in such a way to prevent floating debris from entering the downstream storm sewer system.
3. The outlet structure shall be capable of substantially draining the permanent pool to permit harvesting of wetland vegetation, pond maintenance, or sediment removal.
4. Energy dissipators shall be provided at all stormwater outfalls to prevent channel erosion. These shall be used where discharge velocities exceed 8 fps. and shall reduce the average velocity to 6 fps.

General Considerations

1. The ability of the watershed to sustain a wet detention pond shall be investigated. Factors to be considered shall be the size of the watershed, pond soil conditions, the regional climate, and the typical time interval between runoff events.
2. The following geotechnical characteristics of the proposed pond site shall be determined: depth to bedrock, groundwater table, soil permeability and infiltration rate, and adequacy of the excavated soils for use as embankment fill. It is recommended that the bottom of the pond should be at least 3 ft. above the high water table and/or bedrock elevation.

Phosphorus Concentrations and Export Coefficients

Land Use	Model Parameters			Published Values
	P Concentration	Runoff Coefficient*	P export Coefficients	P export Coefficients
	(ug/l)	(%)	lbs/ac.	lbs/ac.
Agricultural	450	0.25	0.62	0.36 – 1.5
Industrial/Commercial	600	0.49	2.8	0.70 – 3.0
Single Family Residential	450	0.25	0.65	0.45 – 2.7
Multi-Family Residential	500	0.36	1.05	0.45 – 2.7
Open/Undeveloped	200	0.08	0.09	0.09 – 0.3

* 2 year storm frequency (2.5" of precipitation in 24 hours)